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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/072,362

02/07/2002

Kuan-Yu Fu

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2716

7590

11/28/2003

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EXAMINER

HU, SHOUXIANG

ART UNIT

PAPER NUMBER

2811

DATE MAILED: 11/28/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/072,362

Applicant(s)

FU, KUAN-YU

Examiner

Shouxiang Hu

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AW

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 09 September 2003.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 10-18 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 10-18 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 07 February 2002 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. §§ 119 and 120**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☒ Certified copies of the priority documents have been received in Application No. 09/059,548.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
- a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                             | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s) _____   |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)         | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ | 6) <input type="checkbox"/> Other: _____                                    |

## **DETAILED ACTION**

### ***Drawings***

1. The drawings are objected to because Fig 2C contains informal handwritings; and the alleged separate sheets accompanying the 9/9/03 amendment is not found. A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

### ***Claim Objections***

2. Claims 10-18 are objected to because of the following informalities and/or defects:

In claim 10, the terms of "active", as recited in line 4, should read as: --active region--.

At the end of each of claims 10, 13 and 16, the term of "trench" should read as: -- trenches--.

Claims 10, 13 and 16 each recite the subject matter that a first deep source region extending from the first shallow doped region and a second deep drain region are disposed in a region within the substrate deeper than the first and second trenches, but each fail to clarify what are the relationships between the second deep drain region and the second shallow doped region and between the first deep source region and the second deep drain region.

Furthermore, the term of "the second portion of the electrode" recited in claims 10, 13 and 16 should read as: --the second vertical portion--.

Appropriate correction is required.

***Claim Rejections - 35 USC § 112***

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 10-15 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 10 recites the subject matters that the gate electrode completely fills the first and second trenches, but according to the original disclosure, especially see Figs. 4B and 4D, the gate electrode (300) only fills portions of the trenches, as there is a thick insulating layer (302) that fills rest of the trenches.

And, claim 13 recites the subject matter that the deep source/drain regions are doped with dopants of a conductivity type opposite to that in the first and second shallow doped regions, but according to the original disclosure, especially in Fig. 4D, the deep doped regions (306) and the shallow doped regions (304) are of the same type and there is not real boundaries therebetween.

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5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 16-18 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 16 recites the subject matter of the recited horizontal portion "bisecting said first and second vertical portions together"; but fails to clearly and definitely define the subject matter of the instant invention that the horizontal portion connects the first and second vertical portions together, as the word "bisect" may also mean: to cut or divide into two parts, according to The American Heritage® Dictionary of the English Language, Third Edition copyright © 1992 by Houghton Mifflin Company.

### ***Claim Rejections - 35 USC § 102***

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. Claims 10 and 12, 13, 15, 16 and 18, insofar as being in compliance with 35 U.S.C. 112 and as being best understood in view of the claim objections above, are rejected under 35 U.S.C. 102(b) as being anticipated by Lancaster (US 4,835,584).

Lancaster discloses a semiconductor structure (Figs. 1-7F, especially Figs. 4, 5L, and/or 7F), comprising a substrate having an active region including a channel region

(under each bottom of the gate oxide layer 57 in Fig. 5L or 72 in Fig. 7F) and a non-channel region surrounding the channel region; a first trench and a second trench disposed near the channel region, a thick insulating layer (57 in Fig. 5L or 72 in Fig. 7F; a silicon oxide gate insulating layer, about 0.1  $\mu\text{m}$ , see col. 3, line 61) over the first and second trenches and conformal to the profile of the first and second trenches; a gate electrode (58 in Fig. 5L or 75 in Fig. 7F) disposed over the two trenches and comprising a first vertical portion, a second vertical portion and a horizontal portion, with the first vertical portion being embedded inside and substantially fills the first trench, the second vertical portion being embedded inside and substantially fills the second trench, and the horizontal portion being disposed over the substrate and connecting the first and second vertical portions together; a first shallow doped region (the top horizontal portion of region 73 or 77) within the substrate at an upper corner adjacent to the first vertical portion of the gate electrode and a second shallow doped region (the upper horizontal portion of region 74 or 78) at an upper corner adjacent to the second vertical portion of the gate electrode; a deep source region (the lower portion of region 73 or 77) and a deep drain region (the lower portion of region 74 or 78) disposed in a region in the substrate at a depth deeper than the first and second trenches.

### ***Claim Rejections - 35 USC § 103***

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

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invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. Claims 11, 14 and 17, insofar as being in compliance with 35 U.S.C. 112 and as being best understood in view of the claim objections above, are rejected under 35 U.S.C. 103(a) as being unpatentable over Lancaster (US 4,835,584) in view of Kimura (US 5029,321).

The disclosure of Lancaster is discussed as applied to claims 10 and 12, 13, 15, 16 and 18 above.

Although Lancaster does not expressly disclose that the thick insulating layer can be formed through thermal oxidation, one of ordinary skill in the art would readily recognize that such thick insulating layer used as a gate oxide layer can be readily formed through thermal oxidation for achieving high quality in the gate insulating layer, as evidenced in Kimura (see the thermal oxide layer 3 in Fig. 7E).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to make the semiconductor structure of Lancaster with the thick insulating layer (the gate oxide layer) being formed through thermal oxidation, as taught in Kimura, so that a semiconductor device with a high quality gate insulating layer would be obtained.

### ***Response to Arguments***

11. Applicant's arguments filed on 9/9/03 have been fully considered but they are not persuasive. And, the response to these arguments has been incorporated into the

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claims rejections, especially the claim rejections under 35 U.S.C. 112, set forth in this office action.

### ***Conclusion***

12. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shouxiang Hu whose telephone number is (703)306-5729. The examiner can normally be reached on Monday through Thursday, 7:30 AM to 6:00 PM.



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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie C. Lee can be reached on (703) 308-1690. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9318.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

SH  
November 18, 2003

A handwritten signature in black ink, appearing to read "Shouxiang Hu", written in a cursive style.

**SHOUXIANG HU**  
**PRIMARY EXAMINER**